Agilent AA Spectrometer Systems

Site Preparation Guide

Agilent Technologies

Notices

© Agilent Technologies, Inc. 1994, 1995, 1997, 1998, 2000–2003, 2007, 2010 and 2012

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

8510119300

Edition

Thirteenth edition, January 2012

Printed in Australia

Agilent Technologies, Inc.

Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Request for Installation

All preparations have been completed in accordance with the information provided in the Agilent AA Systems Site Preparation Guide. Please arrange for the installation to be completed as soon as possible. I understand that if the installation site is not prepared in accordance with the enclosed instructions, additional installation charges may apply.

Company name: _____ Company address: _____

_____ _____

_____

_____

_____

Name: _____ Position: _____

Telephone: _____ Preferred installation date: _____

Signed: _____ Date: _____

Site Preparation Checklist

Your site must meet all requirements before you request installation. After completing each requirement, place a check in the appropriate check box. Ensure you compare each box with the supplied packing list.

On completion of the site preparation, send this completed Site Preparation Checklist to your local Agilent agent or Agilent sales and service office. As soon as it is received, Agilent or its agent will contact you to arrange a convenient time for installation.

- ❑ Any instrument damage has been reported to the company responsible for transporting the instrument. An Agilent representative was informed of the damage, and a copy of the damage report has been sent to the Agilent office.

21 CFR Part 11 site preparation requirements

- ❑ N/A (Check if 21 CFR Part 11 is not required.)
- ❑ The 21 CFR Part 11 booklet has been received and read, and action has been taken to ensure Section 4 of the 21 CFR Part 11 booklet has been completed.
- ❑ The System Administrator has been notified.
- ❑ Arrangements have been made for the System Administrator to be present during installation.

Requirement	☑
Principal installation area is in compliance with all relevant safety regulations.	☐
Telephone outlet near instrument.	☐
PC components on site.	☐
Brand: _____	
Processor: _____ RAM in MB: _____	
Hard disk size in MB: _____ Operating system: _____	
Printer brand: _____	
Model number: _____	
Laboratory is free of excessive particulate matter.	☐
Lab temperature maintained between 20 and 25 °C (68 and 77 °F).	☐
Workbench requirements met.	☐
Exhaust system is suitable.	☐
Specified electrical supply and power outlets installed.	☐
All gas supplies (at specified purities), regulators, and gas lines are installed.	☐
Waste container appropriate for the chemical waste is prepared.	☐
Water cooling/circulation system and power connections are set up.	☐
Brand and model number: _____	
Serial number: _____	
Entrance to the lab is at least 1450 cm (57.1 in) wide.	☐
Accessories	
SIPS 10/20 Sample Introduction Pump System serial number: _____	☐
SPS Sample Preparation System serial number: _____	☐
VGA 77 Vapor Generation Accessory serial number: _____	☐
GTA Graphite Tube Atomizer serial number: _____	☐
ETC 60 Electrothermal Temperature Controller serial number: _____	☐
Additional accessory serial number: _____	☐
Type and model: _____	
Additional accessory serial number: _____	☐
Type and model: _____	

Contents

1. Safety Practices and Hazards 9
General 9
Electrical Hazards 10
Heat, Vapors and Fumes 11
Compressed Gases and Cylinders 12
Gas Hoses and Connections 13
Ultraviolet Radiation 13
Other 14
Warning and Caution Messages 14
Warning Symbols 14
Color Coding 16
CE Compliance 17
Electromagnetic Compatibility 17
EN55011/CISPR11 17
ICES/NMB-001 18
Flame Operation 19
Flammable solvents 19
Compressed gases and cylinders for flame operation 21
Acetylene 21
Nitrous oxide 23
Burners 23
Nebulizer 24
Liquid trap 25

Heat hazards 26
Perchloric acid 26
Flashbacks 27
Furnace and Zeeman Operation 29
Gases 29
Heat hazards 30
Vapors and fumes 30
Ultraviolet radiation 30
Magnetic field (Zeeman only) 30

2. Introduction 31

Installation Guidelines 31
Recommended PC Configuration 32

3. Laboratory Environment 35

Suitability 35
Environmental Conditions 35
Noise Levels 36
Workbench 36
Weights and Dimensions 37

4. Laboratory Facilities 45

Exhaust System 45
General 45
Agilent exhaust system 47
Electrical Power Supplies 50
Gas Supplies 54

Pressure cylinder storage 54
Gas connection fittings 54
Permitted gas supplies 56
Gas line diameter 56
Air supply 57
Nitrous oxide supply 59
Acetylene supply 61
Gas supplies for Graphite Tube Atomizers (Zeeman and non-Zeeman) 63
Gas supplies for the Vapor Generation Accessory 64
Waste Fluids 64
Special arrangements for use with organic solvents 65
Water Cooling System 66

5. Instrument Shipping Information 69

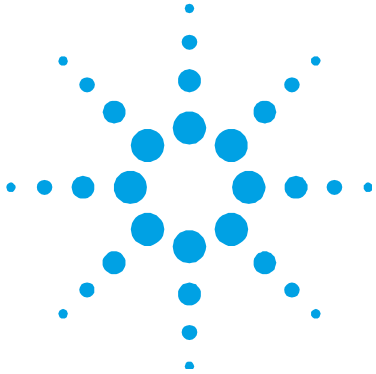
Insurance After Delivery 69
Transit Damage 70
In-House Transit Routes 71

6. Software Installation Guidelines 73

Installing the Microsoft Windows Operating System 73
Installing Agilent SpectrAA Software 74
Installing Agilent SpectrAA CFR Software 74

7. Operator Training 75

This page is intentionally left blank.



1. Safety Practices and Hazards

General	9
Electrical Hazards	10
Heat, Vapors and Fumes	11
Compressed Gases and Cylinders	12
Gas Hoses and Connections	13
Ultraviolet Radiation	13
Other	14
Warning and Caution Messages	14
Warning Symbols	14
Color Coding	16
CE Compliance	17
Electromagnetic Compatibility	17
Flame Operation	19
Flashbacks	27
Furnace and Zeeman Operation	29

General

Your Agilent AA instrument and accessories have been carefully designed so that when used properly you have an accurate, fast, flexible and safe analytical system.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Operation of an atomic absorption spectrometer can involve the use of compressed gases, flames, and hazardous materials including corrosive fluids and flammable liquids. Unskilled, improper, or careless use of this instrument can create explosion hazards, fire hazards, or other hazards which can cause death, serious injury to personnel, or severe damage to equipment and property.

Information on safety practices is provided with your instrument and manuals, and also referenced in your Agilent accessory manuals. Before using your instrument or accessories, you must thoroughly read these safety practices.

Observe all relevant safety practices at all times.

The safety practices described below are provided to help you operate the instrument safely. Read each safety topic thoroughly before attempting to operate the instrument and *always* operate the spectrometer in accordance with these safety practices.

Electrical Hazards

The instrument and accessories contain electrical circuits, devices and components operating at dangerous voltages. Contact with these circuits, devices and components can cause death, serious injury, or painful electric shock.

Panels and covers retained by fasteners that require the use of a tool for removal may be opened only by Agilent field service engineers. Consult the manuals or product labels supplied with your PC, monitor, printer/plotter, water-cooling system and vacuum pump (where required) to determine which parts are operator-accessible.

Application of the wrong supply voltage, connection of the instrument to an incorrectly wired supply outlet, or lack of proper electrical grounding can create a fire hazard or a potentially serious shock hazard, and could seriously damage the instrument and any attached ancillary equipment.

Always use a 3-wire outlet with ground connection that is adequately rated for the load. The installation must comply with local and national safety regulations.

Do not connect the instrument to the mains power supply until you have made sure that the operating voltage is correctly set for the mains power supply in the specific outlet in your laboratory to which the equipment is connected.

Heat, Vapors and Fumes

Heat, vapors and fumes generated by flame, furnace and vapor generation methods can be hazardous to personnel.

Heat, vapors and fumes must be extracted from the instrument by an exhaust system. The instrument must be vented into a self-contained arrangement of collector hood, ducting and exhaust fan. The system must be vented to the outside air, never within the building. Locate the system outlet such that the exhaust cannot re-enter the building through any door, window, air conditioning inlet, or other ventilator. Construct the system in accordance with local codes and regulations for ventilation.

The exhaust system must be capable of providing an exhaust ventilation rate of at least 6 cubic meters per minute (200 cubic feet per minute). Locate the exhaust fan at least 3 meters (10 feet) away from the flame and as close to the outlet as possible. The motor must be mounted away from the hot gases, and plastic parts must not be used as they will melt. Fit a back-draft damper to the outlet end of the system. Equip the exhaust fan power supply with an indicator close to the instrument to indicate whether the exhaust fan is on or off. *Always* switch the exhaust fan on *before* lighting the flame.

Use fire-proof ducting that is in accordance with your local fire prevention regulations. Locate the ducting away from fire alarms, sprinkler heads and other heat-sensitive devices. Do not make solder joints in the ducting – the hot exhaust in the duct may melt the joint.

Regularly check the system by smoke test to ensure that the exhaust system is working.

When operating the atomic absorption spectrometer, *always* have the chimney in place to ensure correct ventilation.

Compressed Gases and Cylinders

All compressed gases (other than air) can create a hazard if they leak into the atmosphere. Even small leaks in gas supply systems can be dangerous. Any leak (except that of air) can cause an explosion hazard, a fire hazard, or result in an oxygen-deficient atmosphere. Such hazards can cause death, serious injury, asphyxiation, anesthetic effects, and serious damage to equipment and property.

Cylinders must be stored and handled strictly in accordance with local safety codes and regulations. Cylinders must be used and stored only in a vertical position. Secure all cylinders to an immovable structure or a properly constructed cylinder stand. The area in which cylinders are stored must be adequately ventilated to prevent toxic or explosive accumulations. Move cylinders only on a properly constructed trolley.

Keep cylinders cool. This rule applies to every cylinder of compressed gas. Cylinders have pressure relief devices that release the contents of the cylinder if the temperature exceeds 52 °C (125 °F).

Ensure that all cylinders are clearly labeled so that there can be no doubt about the contents. If the cylinder label is not legible, do not use the cylinder – return it to your supplier. Always ensure that you have the correct cylinder before connecting the cylinder to the instrument.

If air is supplied from a compressor, all moisture must be extracted from the air before it is supplied to the gas control module. Moisture can affect the internal components of the gas control system and create a potentially hazardous situation.

Use only approved regulators and hose connectors.

Never attempt to refill cylinders.

Remember that for cylinder connections, left thread fittings are used for fuel; right thread fittings are used for support gases.

When your analytical program is complete, or at the end of the working day, always ensure that all gas supplies are turned off at the cylinders.

Gas Hoses and Connections

Even small leaks in gas supply systems can be dangerous. Any leak can create an explosion hazard, a fire hazard, or can result in an oxygen-deficient atmosphere. Such hazards can cause death, serious injury, asphyxiation, anesthetic effects, and serious damage to equipment and property.

Use only approved regulators, connectors and fittings. If in any doubt, consult your local gas supplier or your Agilent representative.

Ensure that all gas connectors and hoses are correctly assembled.

Arrange gas hoses so that they will not be damaged, stepped on, or have things dropped on them.

Never use frayed or damaged hoses.

Perform leak tests at all joints and seals every day before the instrument is used. Test for leaks with a brush and soapy water or a proprietary leak-detecting solution. *Never* use a naked flame when testing for leaks.

Ultraviolet Radiation

Hazardous ultraviolet radiation is emitted by flames, hollow cathode lamps and deuterium lamps. This radiation can cause serious damage to human eyes and skin.

Always wear safety glasses conforming to an approved standard, and certified or otherwise warranted to protect the eyes from ultraviolet radiation. Never look directly at the light emitted by a hollow cathode lamp.

When using a flame, always operate your spectrometer with the flame shield closed, and the sample compartment front panel and chimney in place.

Other

Other specific warnings and cautions appear in the manual and in the Help where appropriate, and detail the specific hazard, describe how to avoid it, and specify the possible consequences of not heeding the warning or caution.

Warning and Caution Messages

WARNING

Name of Warning
A 'Warning' message is used in the text when failure to observe instructions or precautions could result in death or injury.

CAUTION A 'Caution' message is used when failure to observe instructions could result in damage to equipment (Agilent-supplied and/or other associated equipment).

NOTE A 'Note' message is used to give advice or information.

Warning Symbols

The following is a list of symbols that appear in conjunction with warnings in this manual and on the spectrometer. The hazard they describe is also shown. The beginning of the warning text is indicated by a warning icon:

WARNING

A triangular symbol indicates a warning. The meanings of the symbols that may appear alongside warnings in the documentation or on the instrument itself are:

Corrosive liquids

Electrical shock

Explosion hazard

Eye hazard

Fire hazard

Heavy weight (danger to feet)

Heavy weight (danger to hands)

Hot surface

Magnetic field

Moving part

Noxious gases

Sharp object

Toxic material

Read all warnings and cautions carefully and observe them at all times.

The following symbol may be used on warning labels attached to the instrument. When you see this symbol, refer to the relevant operation or service manual for the correct procedure referred to by that warning label:

The following symbols appear on the instrument for your information.

I	Mains power on
O	Mains power off
	Fuse
	Single phase alternating current
	When attached to the rear of the instrument, indicates that the product complies with the requirements of one or more EU directives.
	Flame off
	Flame on
	Indicates lamp present
	When attached to the rear of the product, indicates that the product has been certified (evaluated) to CSA 61010.1 and UL 61010-1.

Color Coding

The various indicator lights appearing on Agilent instruments and associated accessories are color-coded to represent the status of the instrument or accessory.

- A green light indicates the instrument is in normal/standby mode.
- An orange light indicates that a potential hazard is present.
- A blue light indicates that operator intervention is required.
- A red light warns of danger or an emergency.

CE Compliance

Your Agilent AA instrument has been designed to comply with the requirements of the Electromagnetic Compatibility (EMC) Directive and the Low Voltage (electrical safety) Directive (commonly referred to as the LVD) of the European Union. Agilent has confirmed that each product complies with the relevant Directives by testing a prototype against the prescribed EN (European Norm) standards.

Proof that a product complies with these directives is indicated by:

- the CE Marking appearing on the rear of the product, and
- the documentation package that accompanies the product containing a copy of the Declaration of Conformity. The Declaration of Conformity is the legal declaration by Agilent that the product complies with the directives listed above, and shows the EN standards to which the product was tested to demonstrate compliance.

Electromagnetic Compatibility

EN55011/CISPR11

Group 1 ISM equipment: group 1 contains all ISM equipment in which there is intentionally generated and/or used conductively coupled radio- frequency energy which is necessary for the internal functioning of the equipment itself.

Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

This device complies with the requirements of CISPR11, Group 1, Class A as radiation professional equipment. Therefore, there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

Operation is subject to the following two conditions:

1 This device may not cause harmful interference.

2 This device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try one or more of the following measures:

1 Relocate the radio or antenna.

2 Move the device away from the radio or television.

3 Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.

4 Make sure that all peripheral devices are also certified.

5 Make sure that appropriate cables are used to connect the device to peripheral equipment.

6 Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

7 Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

ICES/NMB-001

This ISM device complies with Canadian ICES- 001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

WARNING

Shock Hazard — Fire Hazard — Noxious Gas

The instrument and accessories contain electrical circuits, devices and components operating at dangerous voltages. Contact with these circuits, devices and components can cause death, serious injury, or painful electric shock.

All compressed gases (other than air) can create a hazard if they leak into the atmosphere. Even small leaks in gas supply systems can be dangerous. Any leak can create an explosion hazard, a fire hazard, or can result in an oxygen-deficient atmosphere. Such hazards can cause death, serious injury, asphyxiation, anesthetic effects, and serious damage to equipment and property.

For these reasons, access into the instrument is restricted. The covers on instruments and accessories must not be removed by the operator, except as permitted for the routine maintenance tasks detailed in the relevant operation manuals.

Panels and covers retained by fasteners that require the use of a tool for removal may be opened only by Agilent field service engineers.

Service is to be performed only by Agilent field service engineers.

Flame Operation

Flammable solvents

Unskilled, improper, or careless use of flammable solvents in or near an atomic absorption spectrometer can create explosion hazards and fire hazards. These can result in death, or severe personal injury or burns.

Remember at all times that the combination of a flame and flammable solvents can present a serious hazard. All relevant safety practices governing the use of flammable solvents must be strictly followed.

To reduce the possibility of fire or explosion:

- When initially selecting an organic solvent, choose a solvent having the highest flash point consistent with your analytical requirements.
- Never use a solvent having a specific gravity lower than 0.75.
- Never leave uncovered containers of flammable solvent standing near the burner. When aspirating such solvents, always use a covered container and feed the capillary tubing through a 2-mm diameter hole in the cover. Always use the smallest volume of solvent consistent with your analytical requirements.
- Always use solvent-resistant tubing such as nitrile rubber for the drainage system and the vapor vent. Lead the drainage tube to a suitable wide-necked waste vessel (as described in the next paragraph). The standard plastic laboratory tubing supplied with your instrument is not suitable for draining organic solvents or venting organic vapors. If organic or toxic solutions are being used in the spray chamber, vent tubing must be connected to the vapor vent on the liquid trap, run parallel to the drain tubing, and led to an active exhaust system. Do not lead the vapor tubing to the waste vessel. If you are not using toxic or hazardous liquids in the spray chamber, leave the vapor vent uncovered.
- Use small, wide-necked waste vessels and empty them frequently — do not accumulate large volumes of flammable solvent. Do not use glass waste vessels — use vessels made of a material that will not shatter in the event of a flashback. Metal vessels will corrode, and it is difficult to determine the level of liquid in them. Ensure that your waste vessel is below the instrument and located in an open, well-ventilated position where you can see it. Never locate the vessel in a confined space.
- When your analytical program has been completed, or at the end of the working day, always empty and rinse the waste vessel.
- When your analytical program has been completed, or at the end of the working day, always empty, clean and refill the liquid trap.
- Do not mix nitric or perchloric acid residues with organic solvent residues.

- Keep the burner slot, spray chamber and liquid trap clean.
- Always use the internal igniter to light the flame, as the flame will not operate unless all the safety interlocks are satisfied.

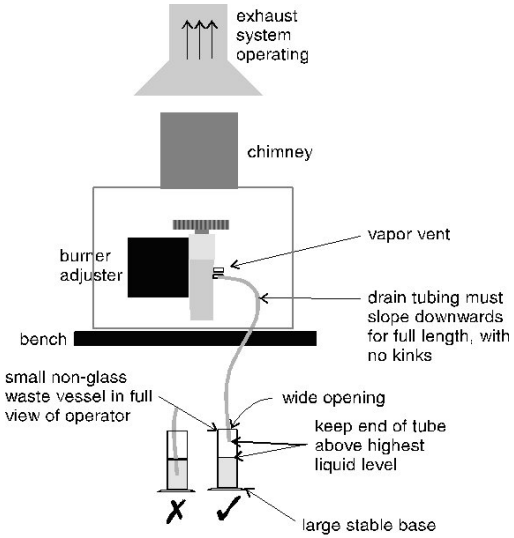

exhaust system operating
chimney
vapor vent
burner adjuster
drain tubing must slope downwards for full length, with no kinks
bench
small non-glass waste vessel in full view of operator
wide opening
keep end of tube above highest liquid level
large stable base

Figure 1. System setup diagram

Compressed gases and cylinders for flame operation

This spectrometer is to be used only with air, nitrous oxide, and acetylene for flame operation.

Never use oxygen or oxygen-enriched air as the oxidant, because this will result in an explosion.

Never use any gas except acetylene as the fuel gas.

Acetylene

Unskilled, improper, or careless use of acetylene can create explosion hazards and fire hazards, which can result in death, severe personal injury or burns.

Use acetylene at pressures lower than 105 kPa (15 psig). At pressures above this level, acetylene can spontaneously explode. Your Agilent AA is designed to operate at fuel supply pressures between 65 and 100 kPa (9.5-14.5 psig). Refer to the Specifications section or the rear of the instrument for the exact range and recommended pressure.

Do not use any tubing or connector that reacts chemically with acetylene. Never pass acetylene through copper tubing, or brass tubing or fittings containing more than 65% copper, since this may provoke an explosion. Never bring acetylene into direct contact with copper, silver, liquid mercury, gaseous chlorine or grease, as an explosion could result.

Use only acetylene that is packed in acetone. Some gas suppliers offer acetylene packed in material other than acetone. While these alternatives may overcome some of the disadvantages of acetone, they may also introduce the more serious problem of corrosion in the gas control module and must not be used with Agilent atomic absorption spectrometers.

If the pressure in the acetylene cylinder is allowed to fall below 700 kPa (100 psig), or the consumption is greater than 1/7 of the cylinder contents per hour, acetone may be carried over from the cylinder and into the spectrometer. Acetone in the spectrometer can damage seals, o-rings and hoses, degrade analytical performance and precipitate flashbacks.

Minimize the amount of acetone that is carried over with the acetylene by:

- Replacing cylinders when their content's pressure drops below 700 kPa (100 psi).
- Ensuring that the rate of acetylene drawn off from each cylinder is not excessive.

If high rates of consumption are observed, then connect two or more cylinders in parallel to a manifold. This reduces the rate at which acetylene is drawn from each cylinder.

To reduce the possibility of fire or explosion:

- Test the supply 'plumbing' regularly for leaks, by using a brush and soapy water or a proprietary leak-detecting solution. (Never use a naked flame when testing for leaks.).
- 'Crack' the cylinder before use by gently opening the valve to check for any drops or spray of acetone. Any cylinder showing acetone should be returned to the supplier for replacement.

Use 'Instrument Grade' acetylene that is at least 99.5% pure.

Turn off fuel gas at the cylinder when you have finished your flame analysis.

Refer also to your local regulations governing the use of acetylene.

Nitrous oxide

The decompression of high pressure N_2O gas at the regulator can cause excessive cooling and eventual freezing of the regulator. To prevent regulator malfunction and possible flashback, the gas should be heated with an in-line or wrap-around heater.

Burners

Improper or careless use of burners can create explosion hazards and fire hazards, which can cause death, serious injury to personnel and damage to equipment and property.

Whenever you handle burners, remember that the burner may be very hot. Always use protective gloves to handle burners.

Burners are clearly identified by the fuel/oxidant combination for which they are intended. Always fit the correct burner. Never attempt to use an air-acetylene burner for nitrous oxide-acetylene, as this will cause a flashback.

Use only acetylene as the fuel gas.

Use only air or nitrous oxide as oxidant. Never attempt to use oxygen or oxygen-enriched air, as this will cause a flashback.

Burner interlocks are incorporated to minimize the possibility of using the wrong burner. Never interfere with or attempt to bypass any interlock fitted to this instrument.

To minimize the rate of burner blockage, the burner slot must be cleaned and polished as described in the Maintenance section.

Never allow burners to become blocked. Progressive burner blockage can increase the static pressure in the liquid trap to the point at which the liquid seal is breached. This can cause a flashback and create an explosion hazard or a fire hazard.

Never allow carbon to build up on the slot, as glowing particles can dislodge and fall through the slot, causing a flashback.

Always turn the flame off before attempting to clean the burner slot. Never clean the slot of a burner while a flame is running.

Never leave a flame unattended.

Never disassemble or modify a burner. *Never* use a damaged burner.

Nebulizer

Incorrect assembly and fitting of nebulizers to an atomic absorption spectrometer can create explosion hazards and fire hazards, which can cause serious injury to personnel, and damage to equipment and property.

Ensure that the nebulizer is correctly assembled and correctly fitted to the spray chamber before lighting the flame. Nebulizers should be correctly adjusted before lighting the flame.

Never remove a nebulizer from the spray chamber while the flame is on, and do not use a mechanical device (for example, a wire) to clean the capillary of a nebulizer while a flame is operating. Always extinguish the flame before removing the nebulizer from the spray chamber.

Regularly test all connections for leaks. Rectify all leaks before lighting the flame.

Liquid trap

Improper use of the liquid trap can create explosion hazards, fire hazards, and toxic vapor hazards, which can result in death or serious personal injury.

The liquid trap interlock is incorporated to minimize the possibility of attempting to operate the instrument with an empty trap or with the drain tube missing. Never interfere with this interlock. Never attempt to bypass this interlock.

Always fill the liquid trap with the same solvent that is being used for your samples.

The trap is designed to provide a liquid seal under all normal conditions with solutions having a specific gravity greater than 0.75. Never use a solution or solvent having a specific gravity lower than 0.75, otherwise the liquid seal can be breached. This can create a flashback and create an explosion hazard or a fire hazard.

A length of tubing must be connected to the drain outlet on the trap and led to a suitable waste vessel. The free end of the tubing must remain above the liquid in the waste vessel. Do not use glass waste vessels — use vessels made of a material that will not shatter in the event of a flashback.

A length of tubing should be connected to the vapor vent (the upper nipple) on the liquid trap when you are analyzing organic or toxic liquids. This tubing should be led out from the sample compartment, parallel to the drain tubing, and *must* slope downwards to enable any liquid overflow to drain out and prevent the tubing from becoming blocked. Do *not* lead the vapor tubing to the waste vessel. If necessary, an active exhaust system should be used to draw away toxic vapors. If you are not analyzing solutions of a toxic nature, leave the vapor outlet uncovered.

Heat hazards

An open flame, burners and other hot surfaces can present heat hazards that can result in severe burns.

When operating a flame system, always operate your spectrometer with the flame shield closed, and the sample compartment front panel in place. Keep your hands out of the sample compartment while a flame is burning.

When operating a flame system, make sure that the chimney is in place with the cutaway skirt (if present) to the back. Before you touch the instrument chimney, turn off the flame and allow the chimney to cool.

When you change burners, remember that the burner may be very hot. Always use protective gloves when removing a burner from the instrument.

Perchloric acid

Aspiration of perchloric acid and perchlorates into a nitrous oxide-acetylene flame can create an explosion hazard, which can result in death or serious injury, including temporary or permanent impairment of hearing.

Do not use perchloric acid unless it is absolutely essential for sample preparation. If perchloric acid must be used, it may be possible to reduce the risk of explosion by taking the following measures:

- Use an air-acetylene flame instead of a nitrous oxide-acetylene flame.
- Reduce the concentration of perchloric acid and metal in all analytical solutions to the lowest practicable level. The concentration of perchloric acid should be reduced in the digestion stage and further reduced by extending the fuming stage.
- Aspirate all solutions for the shortest practicable period.
- Aspirate distilled water between samples. Minimize the aspiration of air.

- Use separate spray chamber/liquid trap and drain assemblies for perchloric acid analyses and organic solvent analyses to prevent perchloric acid from mixing with organic solvent residues.

NOTE When solvent extractions of perchloric solutions are performed, some of the acid may dissolve in the organic solvent that is subsequently aspirated. Also, if the organic solution is aspirated while floating on the surface of the acid, do not allow the capillary tube to drop below the organic layer and suck up aqueous perchloric acid.

When using perchloric acid, wear approved ear protectors and approved safety glasses, and ensure that all instrument safety covers are in position.

Flashbacks

Analysis over many years has shown that in most cases, flashbacks are associated with one or more of the following points. If you experience a flashback, check this list to see if any of the points are relevant, and take steps to remedy the situation.

1 Keep the burner clean. Deposits must not be allowed to build up in or on the burner slot, because they can partially block it (thus causing the pressure to build up in the spray chamber and breach the seal provided by the liquid trap), or glowing particles can fall down through the slot into the spray chamber and ignite the combustible gas mixture inside.

   The use of a hard object to brush off glowing carbon particles during flame operation is not recommended, because of the increased risk of knocking one of the particles down the slot.

   When using an organic solvent, a reduced uptake rate should be used to restrict the amount of liquid fuel that is fed to the flame.

2 The width of the burner slot must not exceed the maximum design specification [Mark VIA: 0.47 millimeter (0.0185 in) for N_2O; Mark 7 0.46 millimeter (0.0181 in) for N_2O; or 0.54 millimeter (0.021 in) for air]. Even a small increase in width can greatly increase the possibility of a flashback occurring.

The burner slot must be regularly cleaned according to the instructions included in the Maintenance chapter of this manual.

3 Ensure that the spray chamber and liquid trap are kept clean.

If dirty solutions are being analyzed (for example, engine oils), ensure that the spray chamber, liquid trap, float and drain tube are regularly cleaned and flushed with a suitable solvent, so that sludge does not build up in the parts.

4 Ensure that the correct o-rings are used on the burner, nebulizer block and nebulizer, and that they remain undamaged.

Damage to o-rings in the spray chamber can result in the leakage of gas, which can be ignited by the flame and, in turn, set fire to the spray chamber.

Damage to o-rings in the nebulizer can allow leakage of the oxidant, which can reduce the total flow of gas through the burner slot, and so increase the possibility of a flashback occurring.

5 The liquid trap must be filled with the same solution as the matrix used for the standards and samples.

6 The drain tube must be attached to the lower nipple of the liquid trap, and it must slope downwards all the way to the drain vessel so that the waste liquid drains smoothly.

The end of the drain tube must not be allowed to drop below the level of the liquid in the vessel. (Conversely, the level of liquid must not be allowed to rise sufficiently to cover the end of the tube.)

When using organic or toxic liquids in the spray chamber, a vent tube must be attached to the upper vent nipple of the liquid trap. It must slope downwards (running parallel to the drain tube) to prevent it becoming blocked should any liquid drain out, and be vented to an active exhaust system.

All of the above points must be observed because a sudden surge of waste liquid can affect the pressure in the spray chamber and result in a flashback.

7 Since N_2O is stored in the cylinder under pressure as a liquid, when it expands through the regulator, it can cool the regulator sufficiently to form ice on the outside and prevent it from operating correctly.

Prevent freezing by using a heater on the N_2O regulator on the supply cylinder. Contact the supplier of the regulator for a suitable heater.

8 As free acetylene is unstable at elevated pressure, it has to be stored in the cylinder by dissolving it in acetone.

If the gas is withdrawn too quickly, or the cylinder pressure is allowed to drop below 700 kPa (100 psi), acetone may be drawn off in sufficient quantities to affect analytical performance, damage seals, o-rings and hoses, or even cause a flashback. Observe the recommendations concerning the use of acetylene.

9 Where possible, you should not perform digests with perchloric acid. As this acid is well-known for forming unstable salts, operators using this acid should ensure that the minimum amount is allowed to reach the spectrometer, and that the burner, spray chamber and liquid trap are thoroughly cleaned after each analysis to ensure that unstable salts are not allowed to build up. Failure to do this can result in unpredictable flashbacks.

10 Aspirating solutions (especially alkaline/ammoniacal ones) that contain high concentrations of Ag and Cu, can lead to the formation of acetylides, which can spontaneously decompose and cause a flashback.

Furnace and Zeeman Operation

Gases

The graphite tube atomizer gas supply system is designed for use with inert gases and air.

Never use pure hydrogen with the graphite tube atomizer, since this could result in leakage and potentially explosive accumulation of hydrogen. You may, however, use a proprietary, pre-packaged mixture of 95% argon (or nitrogen) and 5% hydrogen. *Never* attempt to create your own mixture of hydrogen and an inert gas for use with the GTA system.

Heat hazards

A hot furnace atomizer can present heat hazards, which can result in severe burns to personnel. Never put your hands in the sample compartment while you are operating your furnace.

Allow the furnace atomizer to cool before removing it from the sample compartment.

Vapors and fumes

Never place your head over the graphite tube atomizer while it is operating. This could cause inhalation of hazardous or toxic fumes, or your skin and eyes could be injured by corrosive vapors or fumes.

The chimney or the optional exhaust accessory must be in place for furnace operation, to ensure that toxic vapors and heat are exhausted.

Ultraviolet radiation

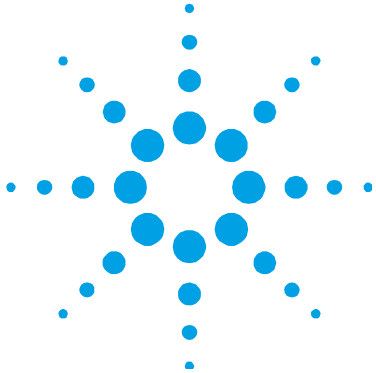
When viewing the sample during the drying stage, use only a rear-coated mirror (as supplied) or the Tube CAM option. *Never* look directly at the furnace during either the ash or atomize stages.

Magnetic field (Zeeman only)

The magnet produces a variable magnetic field of up to 0.8 tesla peak at mains frequency in the workhead during the read stage.

To avoid interference with heart pacemakers or magnetic storage media, keep them at least 300 mm (12 in) from the magnet.

☑ After all safety regulations have been met, check the checklist box: *Principal installation area is in compliance with all relevant safety regulations.*



2. Introduction

Installation Guidelines 31
Recommended PC Configuration 32

This publication contains the information required to successfully prepare a site for an Agilent AA system installation. A copy should be retained for validation purposes. If you have difficulty in preparing for the installation, and for details of operator training courses, contact your Agilent sales or field service representative.

NOTE All information in this manual is accurate at the time or publication. For the most current information, contact your local Agilent representative.

Installation Guidelines

Allow a minimum of four hours for the installation by an Agilent field service engineer. If accessories are included, allow a maximum of 8 hours.

The installation will include:

- Spectrometer installation
- Basic customer training
- Maintenance overview
- Accessory installation

NOTE Installation time will increase if qualification services (IQ/OQ) are required. Contact your local Agilent field service engineer for further details.

We recommend having a telephone outlet near the instrument. This will make it easier for you if you need to seek assistance in operational procedures or apparent fault diagnosis. This can also facilitate remote troubleshooting and diagnosis, where this support option has been included.

☑ If a telephone outlet is near the instrument location, check the checklist box: *Telephone outlet near instrument.*

Recommended PC Configuration

If you are supplying your own personal computer (PC) for use with an Agilent AA instrument, the recommended configuration is shown in Table 1.

Table 1. Recommended PC configuration

- IBM compatible PC with 2.66 GHz processor
- 4 GB RAM
- 500GB Hard disk drive
- 256MB Graphics card supporting 1024 x 768 resolution
- 16 speed DVD drive
- Integrated audio/sound card and speakers
- Keyboard and Mouse
- 19 in LCD Monitor
- Microsoft Windows 7 Professional 64-bit (Service Pack 1) operating system*

NOTE The PC must have one spare full height PCI expansion slot for the Agilent PCI-IEEE interface card.

The Agilent SpectrAA software does not support the AT/ISA PC bus.

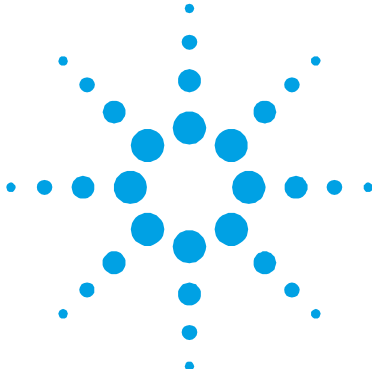
If SPS 3 or ETC 60 accessories are being used an RS232 port is required for each of these.

A USB port is required if the camera option is to be used.

NOTE * Windows XP (SP3), with NTFS file system is required for the SpectrAA CFR version. Currently, SpectrAA CFR is not compatible with Windows 7.

☑ After the PC requirements have been met, enter the requested information and then check the checklist box: *PC components on site.*

This page is intentionally left blank.



3. Laboratory Environment

Suitability	35
Environmental Conditions	35
Noise Levels	36
Workbench	36
Weights and Dimensions	37

Suitability

The instrument is suitable *only* for indoor use and is classified suitable under the following categories (EN 61010-1):

- Installation category II
- Pollution degree 2
- Equipment class I

Environmental Conditions

The area selected for operation of an Agilent AA spectrometer system must be free from drafts, corrosive atmospheres and vibration. Sample preparation areas and materials storage facilities should be located in a separate room.

The area should have a dust-free, low-humidity atmosphere. Air conditioning is strongly recommended for control of the environment. The instrument should not be located near a window, door or any other area where drafts may cause unstable thermal conditions.

☑ After the cleanliness requirements have been met, check the checklist box: *Laboratory is free of excessive particulate matter.*

Table 2. Recommended environmental conditions for Agilent AA spectrometers

	Altitude	Temperature range	Relative humidity (non-condensing)
For operation	0 to 853 m (0 to 2800 ft)	10 to 35 °C (50 to 95 °F)	8 to 80%
	853 to 2133 m (2800 to 7000 ft)	10 to 25 °C (50 to 77 °F)	8 to 80%
For storage	0 to 2133 m (0 to 7000 ft)	5 to 45 °C (40 to 115 °F)	20 to 80%

NOTE For *optimum analytical performance*, it is recommended that the ambient temperature of the laboratory be between 20 and 25 °C (68 and 77 °F).and be held constant to within ±2 °C (±3.6 °F) throughout the entire working day.

☑ After the temperature requirements have been met, check the checklist box: *Lab temperature maintained between 20 and 25 °C (68 and 77 °F).*

Noise Levels

The sound pressure level (SPL) of a flame AA in a 'normal' laboratory environment (≈60 dBA) ambient noise measured at normal operator position is ≈65 dBA. At a distance of 1 meter from the instrument, the SPL is reduced to ≈62 dBA. The likely maximum SPL at a customer location will be greatly influenced by the extraction system.

Workbench

The workbench must be free from vibration, and be stable and strong enough to support the total weight of the equipment to be used. The bench top should be large enough to permit a free circulation of air around the main instrument and each of the accessories.

The information provided in Table 3 will make planning easier. Portable or semi-permanent trolleys can be used as workbenches, but you must lock the wheels. Accessories such as the SPS 3 Sample Preparation System can be positioned on a trolley available from Agilent. To avoid damage from spillage of samples being used, the bench top should be covered with a material that is corrosion-resistant and impervious to liquid spillage. Generally, for comfortable working conditions and ease of access to the instruments, the workbench should be approximately 900 mm (35 in) high.

The location of the workbench may be determined by the need for an exhaust flue to remove fumes and vapors from the spectrometer sample compartment (see Section 4).

Weights and Dimensions

Table 3. Equipment weights and dimensions for Agilent AA systems

System unit	Width	Depth	Height	Weight
55B AA spectrometer	790 mm (31 in)	585 mm (23 in)	575 mm (22.5 in)	56 kg (123 lb)
55B AA shipping dimensions	1200 mm (47 in)	780 mm (31 in)	870 mm (34 in)	97 kg (213 lb)
240 AA spectrometer	790 mm (31 in)	580 mm (23 in)	590 mm (23 in)	56 kg (123 lb)
240Z AA spectrometer. Also requires GTA 120Z (see below)	790 mm (31 in)	580 mm (23 in)	590 mm (23 in)	56 kg (123 lb)
240 AA shipping dimensions	1215 mm (46 in)	820 mm (35 in)	870 mm (35 in)	97 kg (214 lb)
240Z AA shipping dimensions	1215 mm (46 in)	820 mm (35 in)	870 mm (35 in)	86 kg (190 lb)
280FS AA spectrometer	790 mm (31 in)	580 mm (23 in)	590 mm (29 in)	75 kg (165 lb)
280Z AA spectrometer. Also requires GTA 120Z (see below)	790 mm (31 in)	580 mm (23 in)	740 mm (29 in)	61 kg (135 lb)
280FS/Z AA shipping dimensions	1210 mm (48 in)	820 mm (32 in)	1020 mm (40 in)	106 kg (234 lb)
GTA 120 Graphite Tube Atomizer (workhead stowed)	240 mm (10 in)	600 mm (24 in)	580 mm (23 in)	41 kg (90 lb)
GTA 120 shipping dimensions (including PSD 120)	960 mm (38 in)	770 mm (30 in)	850 mm (34 in)	76 kg (167 lb)
GTA 120Z (including workhead)	240 mm (10 in)	600 mm (24 in)	580 mm (23 in)	52 kg (115 lb)

System unit	Width	Depth	Height	Weight
GTA 120Z shipping dimensions (including PSD 120)	960 mm (38 in)	770 mm (30 in)	850 mm (34 in)	87 kg (192 lb)
PSD 120 Programmable Sample Dispenser	300 mm (11.8 in)	380 mm (15 in)	310 mm (12.2 in)	6 kg (13.2 lb)
PSD 120 shipping dimensions	660 mm (26 in)	420 mm (16.5 in)	310 mm (12.2 in)	10 kg (22 lb)
SPS 3 Sample Preparation System	490 mm (19 in)	300 mm (19 in)	515 mm (20 in)	15 kg (33 lb)
SPS 3 shipping dimensions	760 mm (29.9 in)	500 mm (19.7 in)	840 mm (33 in)	31 kg (68.3 lb)
SPS 3 with diluter	572 mm (23 in)	300 mm (11 in)	515 mm (20 in)	18 kg (39.6 in)
SPS 3 with diluter shipping dimensions	760 mm (23.6 in)	500 mm (15.7 in)	840 mm (33 in)	34 kg (74.9 lb)
SPS 3 trolley dimensions	600 mm (23.6 in)	420 mm (16.5 in)	775 mm (30.5 in)	
VGA 77 Vapor Generation Accessory	310 mm (13 in)	210 mm (8 in)	270 mm (11 in)	5.5 kg (12 lb)
VGA 77 shipping dimensions	590 mm (23 in)	475 mm (18 in)	320 mm (12 in)	11 kg (24 lb)
UltrAA Boosted Lamp Supply	240 mm (9 in)	145 mm (6 in)	355 mm (14 in)	7.5 kg (17 lb)
ETC 60 Electrothermal Temperature Controller	260 mm (10 in)	240 mm (9.5 in)	150 mm (6 in)	5 kg (11 lb)
ETC 60 shipping dimensions	385 mm (15 in)	340 mm (14 in)	400 mm (16 in)	8.5 kg (19 lb)
SIPS 10/20 Sample Introduction Pump System power module	225 mm (9 in)	100 mm (4 in)	385 mm (15.5 in)	4.5 kg (10 lb)
SIPS 10/20 pump module	285 mm (11 in)	275 mm (10.5 in)	215 mm (9 in)	4.5 kg (10 lb)
SIPS 10/20 shipping dimensions	620 mm (25 in)	530 mm (21 in)	360 mm (14 in)	15 kg (33 lb)

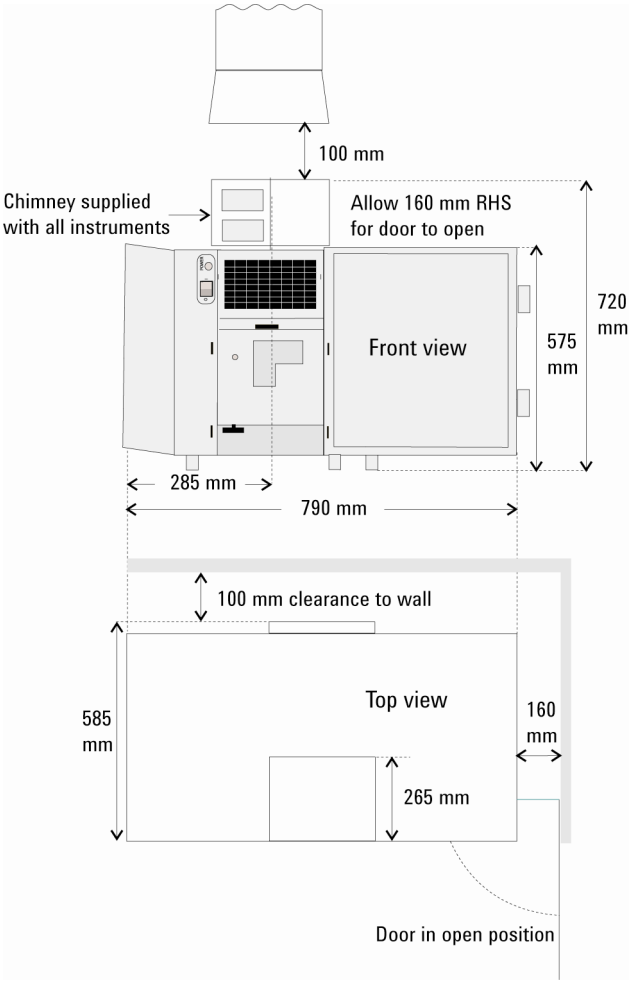


Figure 2. Dimensions of Agilent 55B AA spectrometer

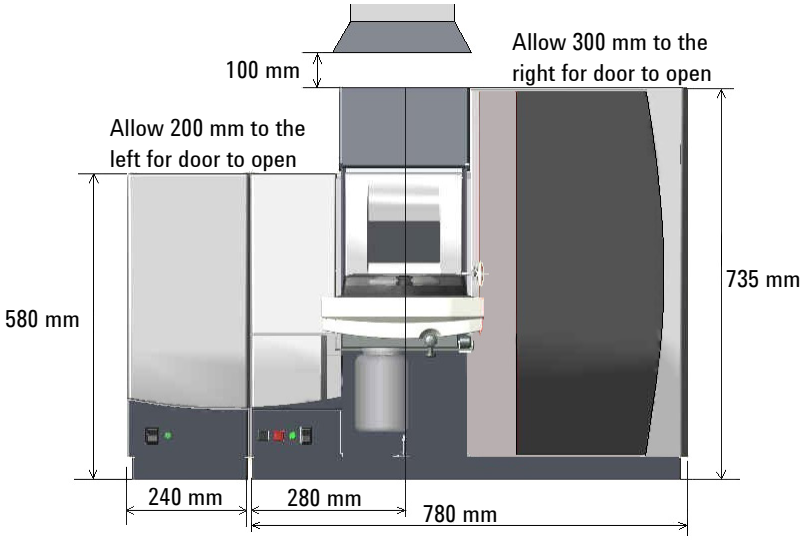


Figure 3. Dimensions of Agilent 280 AA spectrometer with GTA 120 and PSD 120 (front view)

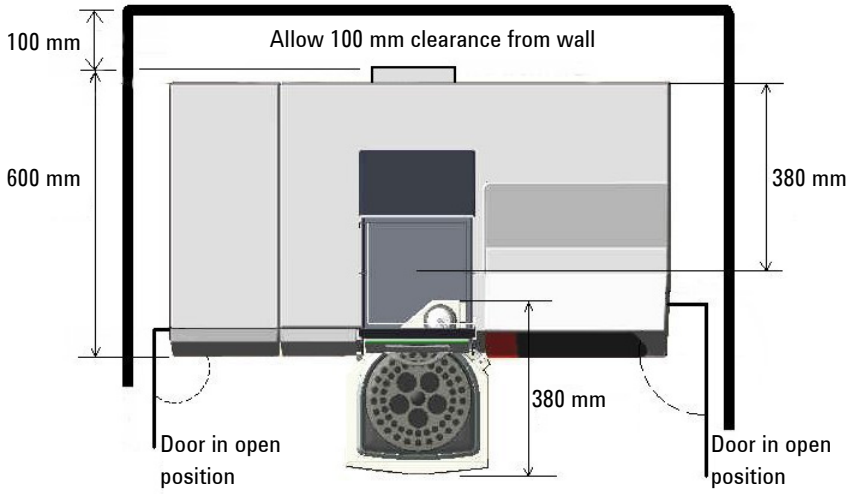


Figure 4. Dimensions of Agilent 280 AA spectrometer with GTA 120 and PSD 120 (top view)

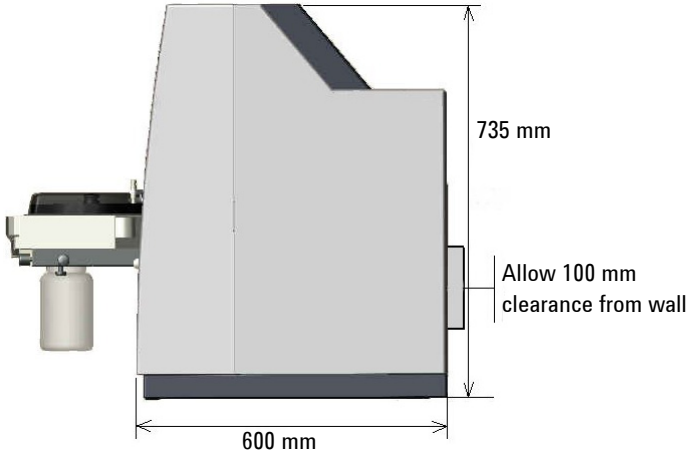


Figure 5. Dimensions of Agilent 280 AA spectrometer with PSD 120 (side view)

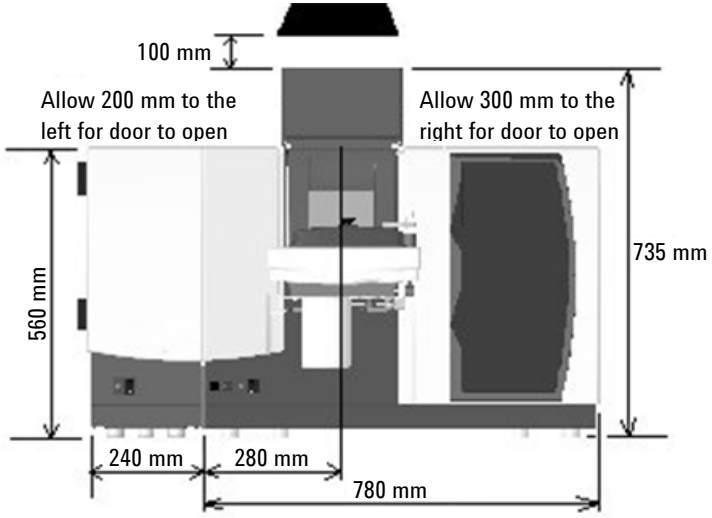


Figure 6. Dimensions of Agilent 240 Series AA spectrometer with GTA 120 and PSD 120 (front view)

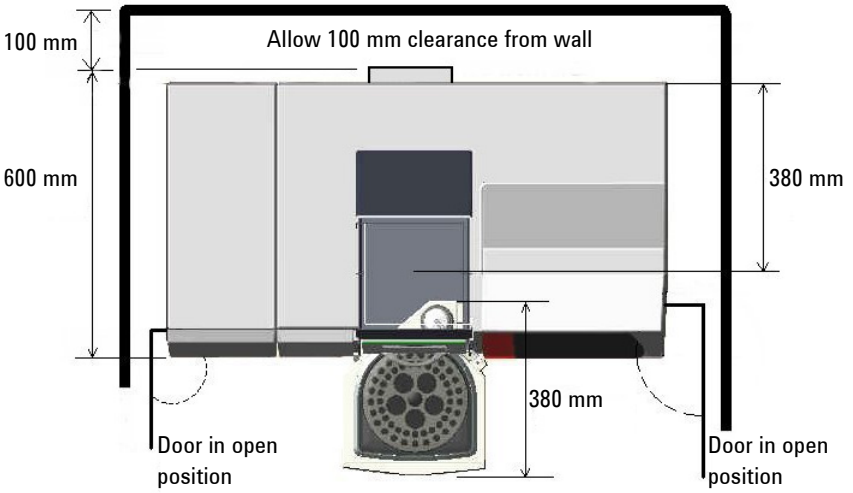


Figure 7. Dimensions of Agilent 240 Series AA spectrometer with GTA 120 and PSD 120 (top view)

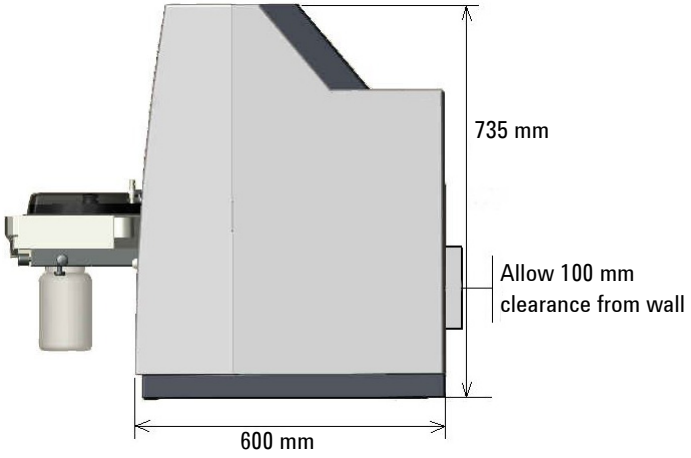


Figure 8. Dimensions of Agilent 240 Series AA spectrometer with PSD 120 (side view)

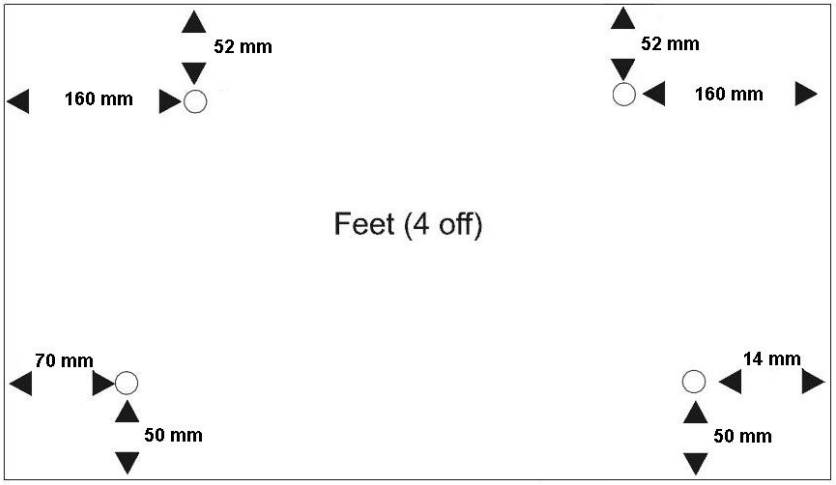


Figure 9. Feet location on the base of Agilent 240/280 Series AA (including Zeeman) spectrometer

☑ After the workbench vibration and location requirements have been met, check the checklist box: *Workbench requirements met.*

This page is intentionally left blank.

4. Laboratory Facilities

Exhaust System	45
Electrical Power Supplies	50
Gas Supplies	54
Waste Fluids	64
Water Cooling System	66

Exhaust System

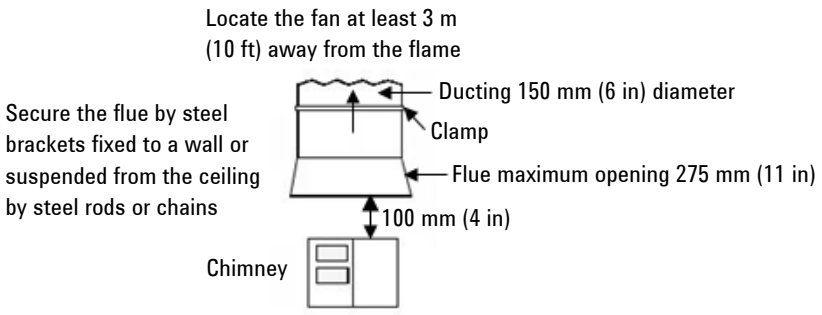

Locate the fan at least 3 m
(10 ft) away from the flame
Secure the flue by steel
brackets fixed to a wall or
suspended from the ceiling
by steel rods or chains
Ducting 150 mm (6 in) diameter
Clamp
Flue maximum opening 275 mm (11 in)
100 mm (4 in)
Chimney

Figure 10. Spectrometer and flue position

General

The flame operates at a temperature of approximately 3000 °C (5400 °F), and can generate up to 540 kilojoules (510 Btu) per minute. Exhaust fumes can be toxic or corrosive. Under extreme flame conditions, the maximum temperature of the exhaust extraction system (based on the Agilent exhaust system) is 65 °C (149 °F) at a distance of 2.2 m (7.2 ft) above the floor level. However, failure of the extraction fan may cause accessible metalwork to become dangerously hot.

The spectrometer must be located under a flue, which is vented by an exhaust fan and ducted to an external vent. The exhaust system with flue, ducting and external vent must provide a minimum flow of 6 cubic meters per minute (200 cfm) at 16-mm water gauge static pressure (free delivery of 11 cubic meters per minute; or 388 cfm).

The exhaust system installation must comply with any rules and/or regulations that may be imposed by local authorities responsible for control of facilities and fixtures in the workplace.

The exhaust fan should be located at least 3 meters (10 feet) away from the flame. The fan blades must be made of metal. The fan control switch and running indicator lamp should be located close to the instrument.

Ducting must be corrosion-resistant and fire-proof, and should be kept clear of fire alarms, sprinkler heads, heat-sensitive devices and combustible materials. It should rise vertically for at least 2 meters (6 feet) from the spectrometer and there should be no tight bends. All ducting joints must be fitted — the hot exhaust gases may melt soldered joints.

The external vent must be fitted with a backdraft damper, and the outlet location must be clear of doors, windows and air-conditioning inlets.

WARNING

Noxious Gas

Any leak can result in an oxygen-deficient atmosphere, which can cause death, serious injury, asphyxiation, anesthetic effects, and serious damage to equipment and property. An exhaust system must be used with Agilent AA flame and furnace instrumentsto remove hazardous and toxic gases.

NOTE The Agilent Furnace Fume Extraction System accessory requires an exhaust ducting size of 150 mm (6 in) to fit the mounting plate.

Agilent exhaust system

The components required for an extraction system may be purchased from Agilent either separately or as a kit of parts ready for installation at the instrument site. To allow for personal preferences in the selection of control gear, switch and pilot light assemblies are not included with the items supplied by Agilent.

Table 4. Agilent exhaust kits

Exhaust kit
Exhaust kit for 240 V, 50 Hz supply
Exhaust kit for 115 V, 60 Hz supply

NOTE Mounting hardware for the flue and fan are not included with the Agilent-supplied exhaust kit.

Each Agilent-supplied exhaust kit contains the following items, which *must* be installed by local fitters before the Agilent field service engineer is called.

Table 5. Exhaust kit components (refer to Figure 11)

Item	Remarks	Qty
1	Exhaust fan (for 240 V, 50 Hz supply only) *or* Exhaust fan (for 115 V, 60 Hz supply only)	1 1
2	Flue without mounting brackets	1
3	Flexible ducting, 1 m aluminum @ ID 150 mm	3
4	Coupling for joints in ducting	2
5	Ducting clamp, 2 per coupling	4

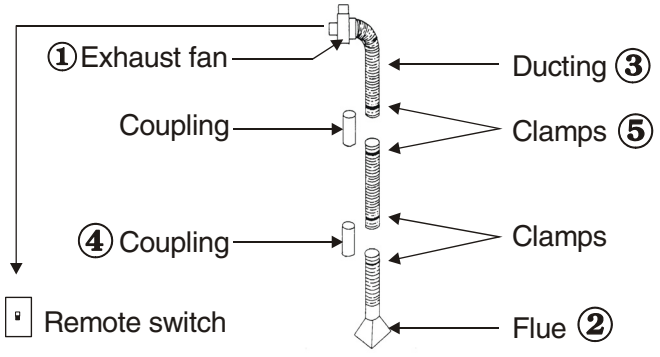


Figure 11. Exhaust kit components

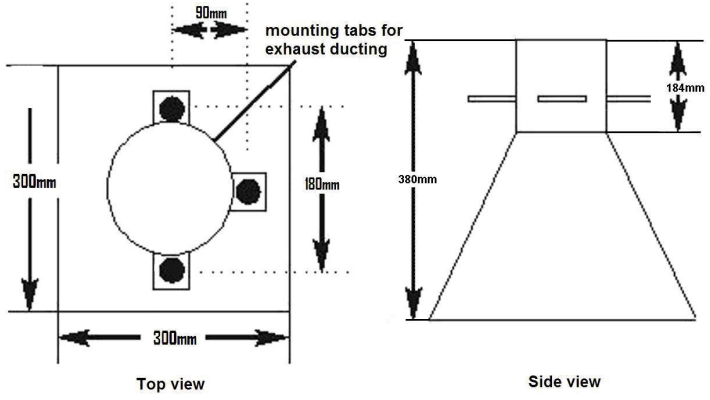


Figure 12. Dimensions for the exhaust flue supplied with the exhaust kit

Table 6. Exhaust fan motor specifications

	240 V, 50 Hz supply	**115 V, 60 Hz supply**
Voltage	240 V single phase	115 V single phase
Current	0.45 A	0.7 A
Frequency	50 Hz	60 Hz
Power input	74 W	200 W
Direction of rotation	Counterclockwise (as seen from shaft end)	
Nominal speed	1300 rpm	

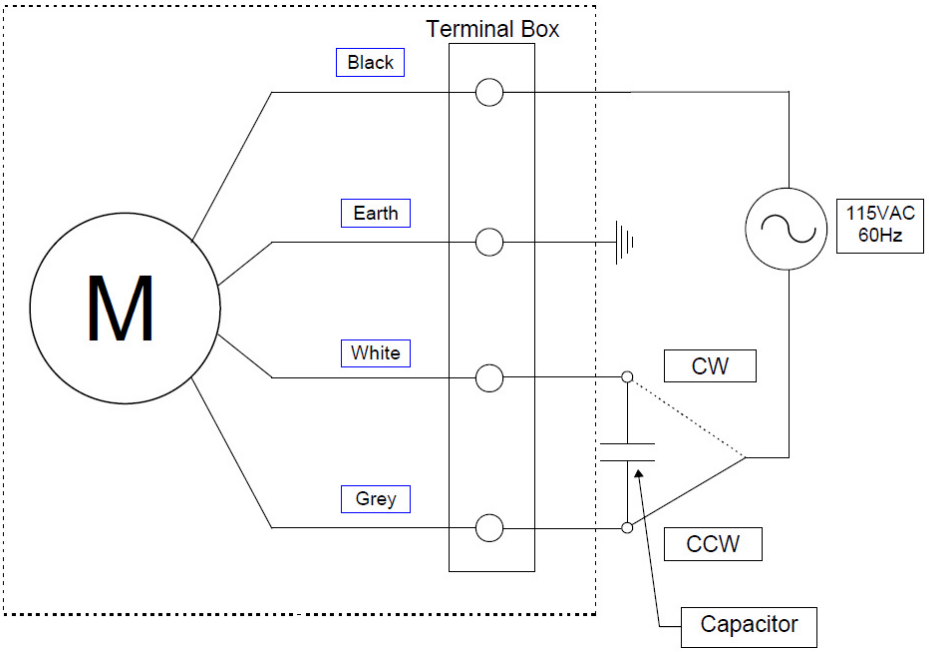


Figure 13. 115 VAC, 60 Hz supply exhaust fan electrical wiring information

NOTE The direction of motor rotation (clockwise or counterclockwise) is as viewed from the shaft end of the motor. The exhaust fan rotation is counterclockwise (CCW) and the motor must be wired accordingly.

NOTE The Agilent-supplied exhaust fan must be configured to operate in permanent split phase mode as shown in Figure 13.

NOTE The direction of motor rotation (clockwise or counterclockwise) is as viewed from the shaft end of the motor. The exhaust fan rotation is counterclockwise (CCW) and the motor must be wired accordingly.

☑ After the exhaust requirements have been met, check the checklist box: *Exhaust system is suitable.*

Electrical Power Supplies

The installation of electrical power supplies must comply with the rules and/or regulations imposed by the local authorities responsible for the use of electrical energy in the workplace.

All Agilent AA instruments are supplied with a 2-meter (6 ft, 6 in) mains power cord terminated as indicated in Table 8.

All power supplies should be single phase AC, 3-wire system (active, neutral and ground, or two actives and ground) and should be terminated at an appropriate connection receptacle that is within reach of the system power cable assembly. In areas where 208/220/240 volt supplies are not normally available in a single phase configuration, supplies may be taken from two phases and ground of a three phase system.

A separate connection receptacle should be provided for each unit in the system (see Table 7). Do not use double adapters or extension cords.

A separate mains circuit individually protected by fuses or circuit breakers must be used for the GTA accessory. It is preferable for the GTA and the instrument to share the same phase.

NOTE If the system being installed is a Zeeman system, then two separate mains circuits individually protected by fuses or circuit breakers must be used — one each for the instrument and the Zeeman GTA accessory. It is preferable for the GTA and the instrument to share the same phase but separate power supply circuits.

Avoid using power supplies from a source that may be subject to electrical interference from other services (large electric motors, elevators, welders and air conditioning units, and so forth).

Table 7. Electrical specifications for Agilent AA systems

System unit	Required supply voltage	Rating
55B AA spectrometer	100 VAC +10% -5% 120, 220 or 240 VAC ±10% 230 VAC +14% -6% 230 VAC +6% -14% 50 or 60 Hz ±1 Hz	170 VA
240 AA spectrometer	100 VAC +10% -5% 120, 220 or 240 VAC ±10% 230 VAC +14% -6% 230 VAC +6% -14% 50 or 60 Hz ±1 Hz	230 VA
280 AA spectrometer	100 VAC +10% -5% 120, 220 or 240 VAC ±10% 230 VAC +14% -6% 230 VAC +6% -14% 50 or 60 Hz ±1 Hz	230 VA
240 Z AA spectrometer	208 to 240 VAC ± 10 % 50 or 60 Hz ± 1 Hz	3500 VA*

System unit	Required supply voltage	Rating
280 Z AA spectrometer	208 to 240 VAC ± 10 % 50 or 60 Hz ± 1 Hz	3500 VA*
GTA Graphite Tube Atomizer GTA 120	208, 220 or 240 VAC ±10% 230 VAC +6% -14% 50 or 60 Hz ±1 Hz	3500 VA*
SIPS 10/20 Sample Introduction Pump System	100 to 240 VAC ± 10 %	55 VA
SPS 3 Sample Preparation System	100 to 240 VAC 50 to 60 Hz ±1 Hz	75 VA
VGA 77 Vapor Generation Accessory	100, 120, 220 or 240 VAC ±10 % 230 VAC +14% -6% 230 VAC +6% -14% 49 to 61 Hz	24 VA
ETC 60 Electrothermal Temperature Controller	110 to 120, 220 to 240 VAC ±10 % 50 or 60 Hz ±3 %	550 VA maximum
UltrAA Boosted Lamp Supply	100, 120, 220 or 240 VAC ±10 % 230 VAC +14% -6%, 230 VAC +6% -14% 50 to 60 Hz ±1 Hz	150 VA

* In normal operation, the Zeeman and GTA units will draw surge currents in excess of the nominal rating. Power supplies to these units must be isolated from other supplies to the system, and should include delayed action protection devices such as circuit breakers or motor start fuses.

Surges in the Zeeman instrument occur in the ‘read’ cycle during atomization and may be up to 28 amps for up to 10 seconds in any 1 to 2-minute period.

Surges in the GTA accessory depend on the choice of ramp rate and programmed temperature, and may be up to 35 A for approximately 1 second, reducing to about 20 A for up to 10 seconds, perhaps repeating every 1 to 2 minutes.

Table 8. Agilent AA spectrometer power connections

	Standard	GTA 120 or Zeeman
Plug supplied		
Australia -00	10 A, 250 VAC. Complies with AS3112.	Clipsal 439D15M
USA -01	Complies with NEMA 5-15P	Complies with NEMA L6-30P (Hubbell #2621)
Canada -01	Complies with NEMA 5-15P	20 A, 250 VAC. Complies with NEMA L6-20P (Hubbell #2321+).
Europe -02	Perena 3410. Complies with CEE 7 Sheet VII or NFC 61.303.	Kaiser CEBEC 616 VDE. Complies with DIN 49441R2.
Required wall socket type		
Australia -00	General purpose 10 A 250 V outlet (HPM 787, Clipsal 15)	Dedicated circuit, 15 A 250 V outlet (HPM 787/15, Clipsal 15/15
USA -01	Complies with NEMA 5-15R (15 A supply) (Hubbell IG 5262)	Complies with NEMA L6-30R (30 A supply) (Hubbell #2626)
Canada -01	Complies with NEMA 5-15R (15 A supply) (Hubbell IG 5262)	20 A, 250 VAC. Complies with NEMA L6-20R (Hubbell #2326+)
Europe -02	Complies with CEE 7 standard No.7 Sheet VII, or Norma Francais C61.303 Sheet V.A.	No standard known (Kaiser CEBEC 702 type 31/131.5)
Power supply, current rating and overload protection	Between 5 and 20 A	Between 30 and 40 A
Power supply	Single phase	Single phase

☑ After the electrical requirements have been met, check the checklist box: *Specified electrical supply and power outlets installed.*

Gas Supplies

All gas supply installations must comply with rules and/or regulations that are imposed by the local authorities responsible for the use of compressed gas energy in the workplace. The following points should be considered.

Pressure cylinder storage

Cylinders containing gas under pressure should be firmly secured to a rigid structure, and the storage area must be adequately ventilated. Acetylene cylinders should always be stored and moved in an upright position to avoid acetone saturation of the fibrous safety disc and acetone contamination of the acetylene flow. Acetone contamination *will* cause erratic analytical results and *may* damage the instrument. Such damage is *not* covered by the instrument warranty.

Never locate gas cylinders near a source of ignition, or in a position that is subject to direct heat. Gas storage cylinders often incorporate a pressure release device, which will discharge the gas at a pre-determined temperature, usually around 52 °C (125 °F). See Figure 14.

If gases are to be plumbed from a remote storage area to the instrument site, ensure that the local outlets are fitted with stop-valves and pressure gauges that are easily accessible to the instrument operator. Stop valves *must* be rapid action shutoff and should be mounted near the side of the instrument, not behind it, and *never* near or above the sample compartment. The gas outlets must be provided within 1.5 m (5 ft) of the instrument. See Figure 15.

If a pressure regulator is used at a local outlet, it is necessary to ensure that its input pressure is always at least 40% greater than its output pressure, under all combinations of input pressure and gas flow. The effect of supplying multiple instruments through long supply pipelines must be taken into consideration.

Gas connection fittings

Gas fittings may vary among suppliers. If you have difficulty obtaining the correct fittings for *direct* connection of gas supplies to the spectrometer, contact Agilent for assistance.

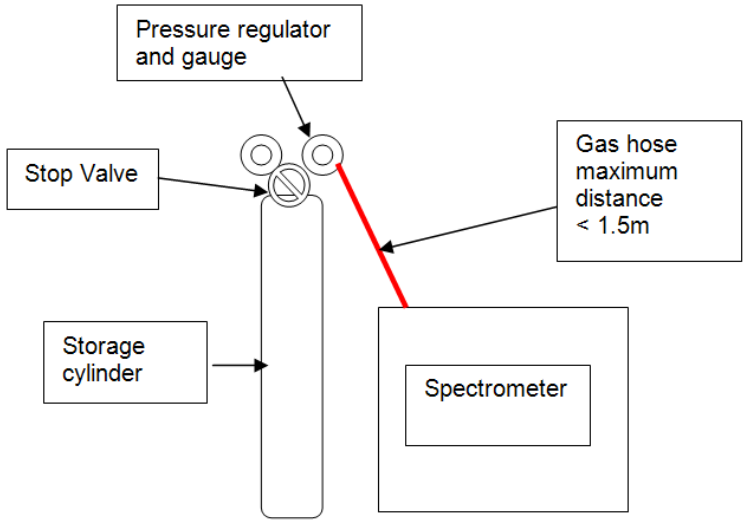


Figure 14. Direct gas connection

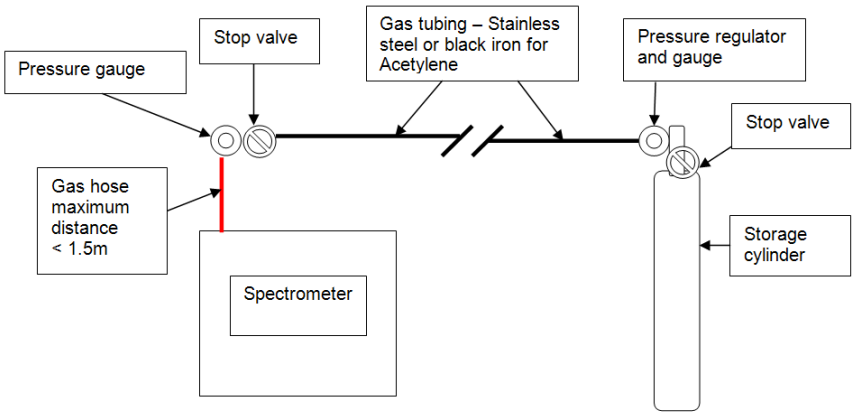


Figure 15. Remote storage location gas connection

Permitted gas supplies

Only three gases are specified for use in a flame instrument. They are air, nitrous oxide and acetylene. Agilent will *not* install a flame instrument where other gases may be provided for connection to it. The GTA accessory requires an inert gas (argon or nitrogen), and can use air or other gases as an alternate gas, but does not use nitrous oxide and acetylene.

In planning your gas reticulation scheme, observe the following points:

- *Never* run rubber tubing through a wall or across a floor.
- *Never* use rubber tubing outdoors.
- Acetylene tubing *must* be stainless steel or black iron.
- Use only *refrigeration-grade* copper pipe for other gases — plumbing-grade has oil and grease residues.
- Do *not* cut off the factory-fitted hose connectors. These are needed to connect to test equipment gas-handling jigs. Their removal will cause extra expense during service calls.
- Use only 3/8-in tube or 1/2-in pipe to minimize pressure drop.
- Fit pressure gauges on a wall at the supply point, and ensure that they are visible to the operator.

Place cutoff valves in a position that can be reached safely in case of a fire.

WARNING

Fire and Explosion Hazard

Fire and/or explosion hazard, which could result in death or serious injury to personnel and damage to property. Agilent AA instruments are designed for flame operation only with acetylene and air, or acetylene and nitrous oxide. The use of unspecified gases for flame operation of the spectrometer is extremely hazardous. Use only the specified gases, and ensure that the installation complies with the relevant rules and regulations as laid down by the appropriate authorities in your region.

Gas line diameter

All gases should be supplied through gas lines with an internal diameter no smaller than 6.4 mm (1/4 in).

Air supply

Table 9. Air supply specifications

Parameter	Specification
Quality	Clean, dry, free of oil
Permissible pressure range	245 to 455 kPa (35 to 65 psi)
Recommended pressure	350 kPa (50 psi)
Normal flow rate	13.5 to 20 L/min

WARNING

Fire and Explosion Hazard

Fire and/or explosion hazard, which could result in death or serious injury to personnel and damage to property. Air enriched with oxygen, or pure oxygen, must *never* be used with a flame instrument, as it will cause a flashback.

The instrument air hose is fitted with a US Standard Compressed Air Connection, Female Union, Size 9/16 in - 18 UNF. The hose is 1.8 m (6 ft) long. Connection adapters are supplied to suit different locations, as illustrated in Figure 16.

The air supply must be regulated to maintain the instrument operating pressure over the full range of normal flow rates. A dual-stage regulator should be used. This is most important for instruments with programmable flow rates because a slow response from the regulator may cause the instrument to shut down during a demand for increased flow. A shutdown of this kind is safe and does not imply a fault in the instrument, but will interrupt your work.

If you choose to use an air compressor, it must be installed in a remote location where its intake is fed from a dry, dust and vapor-free environment. The control switch and pilot light should be mounted close to the instrument.

Where the air supply is derived from a general purpose in-house system or from a *dedicated* air compressor, a filter unit *must* be installed. If your location has high humidity, the air supply should include a dryer or condenser device.

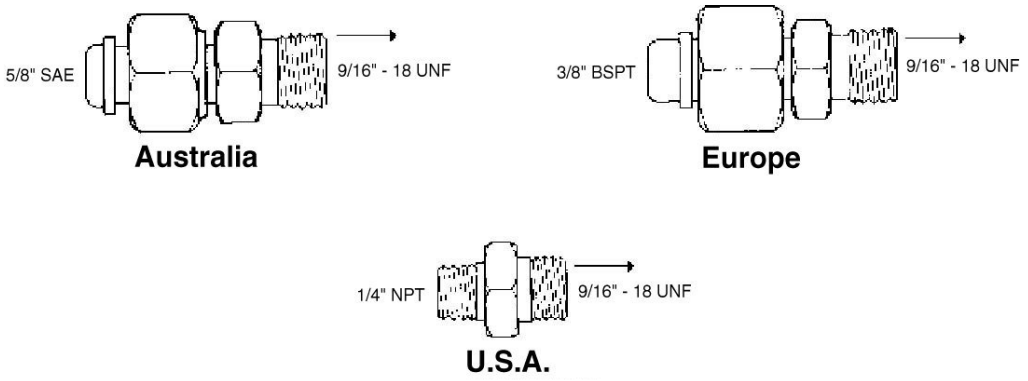


Figure 16. Air supply connection adapters

Table 10. Air supplies

Description
230 V 50 Hz Compressor with Air Service Unit
115 V 60 Hz Compressor with Air Service Unit
Air Service Unit (includes air filter, pressure regulator and emergency air reservoir)
Air filter maintenance kit

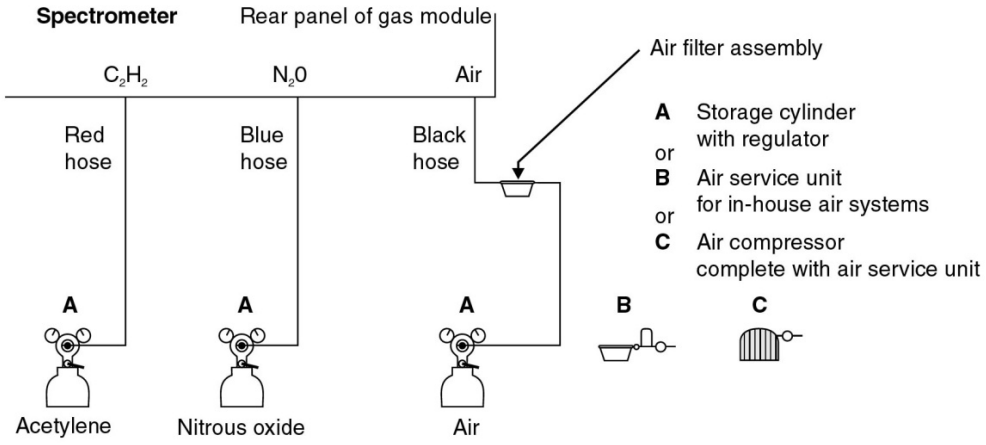


Figure 17. Gas supplies

Nitrous oxide supply

Table 11. Nitrous oxide supply specifications

Parameter	Specification
Quality	Instrument-grade, 99.5% pure (minimum)
Permissible pressure range	245 to 455 kPa (35 to 65 psi)
Recommended pressure	350 kPa (50 psi)
Normal flow rate	11 to 16 L/min

NOTE Instrument-grade nitrous oxide must be used. If you choose to use industrial-grade, instrument performance is not guaranteed.

The instrument nitrous oxide hose is fitted with a US Standard Nitrous Oxide Gas Connection, Female Union, Size 3/4 in - 16 UNF. The hose is 1.8 m (6 ft) long. Connection adapters are supplied to suit different locations as illustrated in Figure 18.

The nitrous oxide supply must be regulated to maintain the instrument operating pressure over the full range of normal flow rates. A dual-stage regulator should be used. This is most important for instruments with programmable flow rates because a slow response from the regulator may cause the instrument to shut down during a demand for increased flow. A shutdown of this kind is safe and does not imply a fault in the instrument, but will interrupt your work.

Nitrous oxide is stored as a liquid. Evaporation across the regulator may cause it to freeze at high flow rates. This can cause erratic flame conditions and in extreme cases, may cause a flashback. You can purchase a pre-heater, which will prevent freezing. Your Agilent sales and service office can advise you and can supply these devices:

Table 12. Nitrous oxide supplies

Region	Description
North America	Regulator with integral thermostatted heater
Continental Europe	Heater, for connection between cylinder and regulator

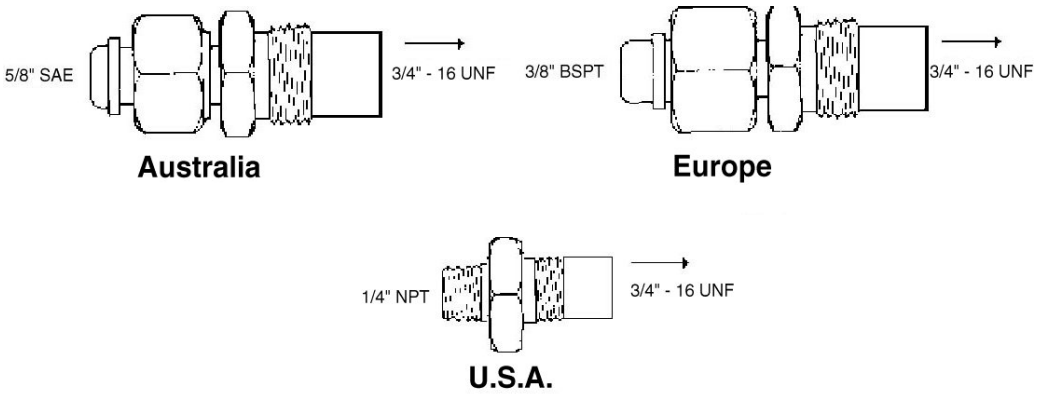


Figure 18. Nitrous oxide supply connection adapters

Acetylene supply

Table 13. Acetylene supply specifications

Parameter	Specification
Quality	Instrument-grade, 99.0% pure (minimum)
Permissible pressure range	65 to 100 kPa (9.5 to 14.5 psi)
Recommended pressure	75 kPa (11 psi)
Normal flow rate	0 to 10 L/min
Packaging solvent	Acetone

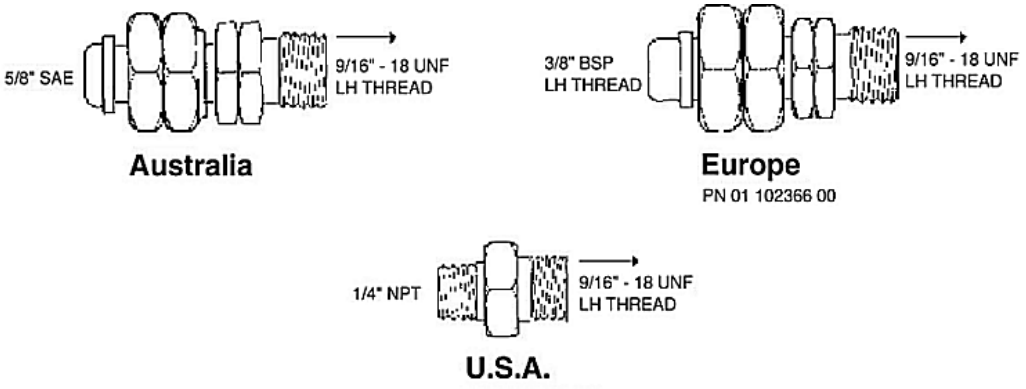


Figure 19. Acetylene supply connection adapters

The instrument acetylene hose is fitted with a US Standard Acetylene Gas Connection, Female Union, Size 9/16 in - 18 UNF, left thread. The hose is 1.8 m (6 ft) long. Connection adapters are supplied to suit different locations as illustrated in Figure 19.

The acetylene supply must be regulated to maintain the instrument operating pressure over the full range of normal flow rates. A dual stage regulator should be used. This is most important for instruments with programmable flow rates because a slow response from the regulator may cause the instrument to shut down during a demand for increased flow. A shutdown of this kind is safe and does not imply a fault in the instrument, but will interrupt your work.

Acetone, the acetylene packaging solvent, can damage neoprene, rubber and plastic components of the instrument. It can also absorb ultraviolet light and may affect analytical performance. High levels of acetone will reduce the flame temperature, which may affect analytical results at many wavelengths. Acetone may be entrained in the acetylene gas at low cylinder pressure.

NOTE You must replace the cylinder when its pressure falls to 700 kPa (100 psi) to prevent acetone from being entrained in the acetylene gas and causing damage to the instrument. Acetone may also be entrained if the flow rate exceeds 1/7th of the cylinder contents per hour. Your supplier can advise you on an appropriately rated cylinder.

Instrument-grade acetylene is free of phosphorus, arsenic and sulfur contaminants, which are residues of the acetylene generation process (calcium carbide and water). Phosphine content is also minimized. Phosphine contamination will depress calcium, strontium and barium absorption signals. Broadband emission from phosphine combustion products can interfere with sodium and potassium analysis.

Acetylene is unstable as a free gas under pressure and it should not be piped at pressures exceeding 105 kPa (15 psi). *Explosive* acetylides can form if acetylene contacts unalloyed copper, silver or mercury.

WARNING

Fire and Explosion Hazard

Fire and/or explosion hazard, which could result in death or serious injury to personnel and damage to property. Never use copper tubing or tubing of alloys with more than 65% copper content. With these materials, copper acetylide could be formed and there is the risk of spontaneous fire or explosion.

Always use stainless steel, or black iron pipe for fixed supply lines, and test for leaks at regular intervals. The installation of acetylene gas must comply with the rules and regulations of the relevant local, state and federal authorities.

Gas supplies for Graphite Tube Atomizers (Zeeman and non-Zeeman)

Argon, nitrogen and air are the *only* gases recommended for use with an Agilent GTA. Proprietary mixtures of argon or nitrogen containing up to 5% hydrogen may be used. If your applications require other gases, contact your Agilent sales and service office.

Table 14. GTA gas supply specifications

Parameter	Specification
Normal gas inlet quality	High purity argon, 99.99% pure (minimum) High purity nitrogen, 99.99% pure (minimum)
Alternate gas inlet quality	High purity nitrogen, 99.99% pure (minimum) Air, clean, dry and free of oil
Recommended pressure range	140 to 200 kPa (20 to 30 psi)
Maximum pressure	350 kPa (50 psi)
Normal flow rate (GTA 120)	0 to 0.3 L/min for internal flow, plus separate external flow of 0.5 L/min. Additional Boost flow of 3.0 L/min during atomization when programmed temperature exceeds 400 °C.

The GTA control unit is fitted with standard barbed-tail adapters for connection of gas supplies using reinforced plastic tubing (supplied) of 6 mm (1/4 in) internal diameter.

GTA gas supplies must be regulated to maintain the accessory operating pressures over the full range of normal flow rates under dynamic conditions. Dual-stage regulators should be used.

Gas supplies for the Vapor Generation Accessory

Argon and nitrogen are the only gases recommended for use with the Agilent VGA. If your applications require other gases, contact your Agilent sales and service office.

Table 15. VGA gas supply specifications

Parameter	Specification
Quality	High purity argon, 99.99% pure (minimum) or High purity nitrogen, 99.99% pure (minimum)
Permissible pressure range	300 to 400 kPa (43 to 57 psi)
Recommended pressure	300 kPa (43 psi)
Normal flow rate	0.05 to 0.1 L/min

The VGA is fitted with 6-mm (1/4-in) internal diameter reinforced plastic hose for connection to a standard 6-mm (1/4-in) barbed-tail connector.

VGA gas supplies must be regulated to maintain the accessory operating pressure at its normal flow rate.

The VGA gas outlet should be fitted with a shutoff valve to prevent the loss of approximately 50 mm per minute of inert gas, which continues to flow when the VGA power is turned off.

☑ After the gas requirements have been met, check the checklist box: *All gas supplies (at specified purities), regulators, and gas lines are installed.*

Waste Fluids

The Agilent AA flame instrument atomizes only a small percentage of the sample taken up. The excess liquids from the spray chamber must be drained into a waste vessel. Suitable tubing is supplied with the spectrometer for use with inorganic solvents. If you use organic solvents, you will need different tubing, suitable for the solvent(s) of choice.

The Agilent AA instrument also needs a drain or a sump for disposal of waste liquid during rinse cycles when flame or furnace autosamplers are used.

A chemically-inert container, not glass and not narrow-necked, to hold approximately 2 liters (4 pints) of waste must be provided by the instrument user. It should be located underneath the sample compartment (or on the side to the right of the spectrometer), where it is protected by the bench and in full view of the operator.

Special arrangements for use with organic solvents

If organic solvents are used in a flame system, the following special option fittings are recommended.

Table 16. Optional fittings for organic solvent waste fluids

Item
Kit, O-rings (Organics)
Tube, butyl, 9 mm ID, 15 mm OD (1 m length)

A suitable outlet for the liquid trap vent pipe must also be provided. A venting tube should be connected to the vapor vent (the upper nipple) on the liquid trap when you are analyzing organic or toxic liquids. This tubing should be led out from the sample compartment, parallel to the drain tubing, and *must* slope downwards to enable any liquid overflow to drain out and prevent the tubing from becoming blocked. Do *not* lead the vapor tube to the waste vessel.

Note the following:

- The venting tube cannot be routed upwards within the sample compartment, because the heat from the flame will melt it.
- If organic vapors are vented to the exhaust system, they may be ignited by the flame and so cause damage to the exhaust system.
- Local environmental protection laws may prohibit toxic vapors from being discharged in to the general atmosphere or into a working area.

- If necessary, an active exhaust system should be used to draw away toxic vapors and neutralize them. If you are not analyzing solutions of an organic or toxic nature, leave the vapor outlet on the spray chamber uncovered.

☑ After the waste fluid container requirements have been met, check the checklist box: *Waste container appropriate for the chemical waste is prepared*.

Water Cooling System

The Graphite Tube Atomizer must have a supply of cooling water to remove heat from the furnace workhead.

Table 17. GTA water cooling system specifications

Parameter	Specification
Required flow rate	1.5 L/min at 180 kPa (27 psi)
Maximum pressure	200 kPa (30 psi)
Recommended inlet temperature	18 to 25 °C (64 to 70 °F)
Maximum temperature	40 °C (104 °F)
Minimum temperature	10 °C (50 °F)

A suitable regulator is included in the GTA 120 control unit. It will be adjusted, if necessary, by the customer support representative. Pressure regulation is recommended for supplies that may exceed the maximum permissible pressure.

The temperature of the furnace coolant is detected by an interlock device, which will stop operation if the cooling water reaches 40 degrees Celsius (104 °F). Where the ambient temperature is high or where a low-capacity water cooling system is used, you may need to include some form of heat exchanger to maintain the recommended water inlet temperature.

Provided that the flow rate can be maintained above 1.5 liters per minute and there is no backpressure at the outlet, the cooling water supply may be taken from an in-house domestic water system, if local regulations permit.

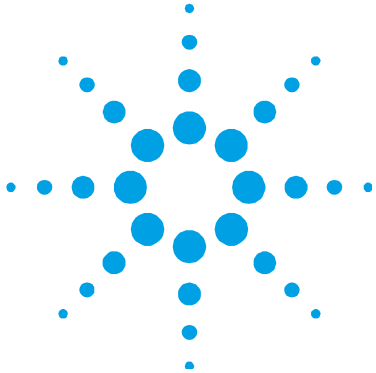
An alternative is to install a small recirculating system, which should have a tank capacity of at least 100 liters (22 Imperial gallons). The tank should be covered to prevent contamination by dust and other impurities and to minimize evaporation loss. Algicide should be used. A heat exchanger may be necessary. Any such installation must be capable of extracting 950 W at 20 °C de-rated by 17% for 50 Hz operation.

A refrigerated water cooler has the advantage of not needing a large held volume of water. There are many types available. When choosing a water cooler, check that the specifications meet the requirements of the GTA.

Your local Agilent office or representative may be able to supply a suitable refrigerated water cooler for use with the Agilent GTA. Contact your local office or representative for details if required.

☑ After the water cooling requirements have been met, enter the requested information and then check the checklist box: *Water cooling/circulation system and power connections are set up.*

This page is intentionally left blank.



5. Instrument Shipping Information

Insurance After Delivery 69
Transit Damage 70
In-House Transit Routes 71

Insurance After Delivery

As the carrier's liability ceases when the equipment is delivered, Agilent recommends that you arrange separate insurance that will cover transportation from the delivery point to the installation site. The delivery point will vary according to the carrier, the shipping method, and in some cases the terms of sale. Some carriers will only deliver to their own distribution centre, while others may deliver to your off-loading bay. Few will deliver to the actual installation site.

Transit Damage

Transit damage can be obvious or concealed, and in either case will only be admitted by the carrier if it is reported as agreed in the terms of the carrier's agreement. For any claims against damage in transit, the following general rules apply:

1. Before accepting delivery, you should inspect the packages for signs of obvious damage. The nature of any obvious damage must be noted on the carrier's way-bill, and then must be countersigned by a representative of the carrier.
2. Within the time limits stated in the terms of conditions of carriage, a further inspection must be made for concealed damage. If any damage is found at this stage, the carrier must be notified in writing and all packaging material must be retained for subsequent inspection by a representative of the carrier.
3. A copy of any damage report must be forwarded to the Agilent sales office dealing with the supply of the equipment.

Agilent instruments are inherently robust, and the packaging is designed to prevent internal damage when shipped or handled in accordance with the labels and warnings. However, it must be remembered that the contents form part of a precision measuring system, and all packages should be handled accordingly. In transit, sharp jolts and shocks must be avoided, and the packages must not be unnecessarily inverted or tilted. Markings on the shipping cartons generally indicate which side of the package should be kept at the top.

WARNING

Heavy Weight

Many of the packages are large and heavy. To avoid injury to personnel, or accidental damage to the equipment, always use two or more people when lifting equipment into position. Never attempt to lift packages alone.

WARNING

Shock Hazard

To prevent death or personnel injury from accidental contact with high voltages within the instrument, do not remove any of the instrument covers. Do not connect the instrument to the mains supply.

In-House Transit Routes

In-house transit routes must be carefully considered. Vertical, horizontal and turning clearances should be calculated from the shipping crate dimensions of the spectrometer, which is the largest unit in any system arrangement.

Figure 20 provides an indication of the minimum turning clearance and minimum door width required for the spectrometer in its shipping crate.

Particular attention should be made to the clearance of any doors in the transit route to the laboratory. The required turning and door clearance may need to take into consideration any lifting device used for transporting the instrument (for example, fork lift, pallet truck or trolley).

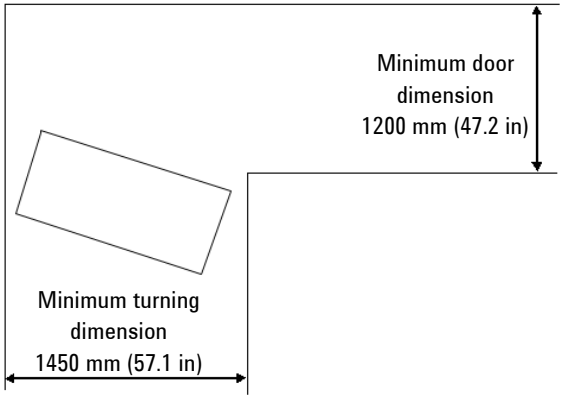
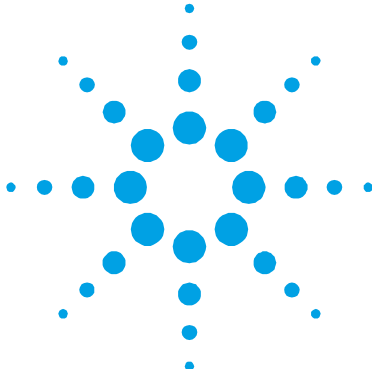


Figure 20. Minimum clearance required for transportation in the shipping crate (Agilent 55B/240/280 AA)

Carefully check the clearance of any doors in the transit route to the laboratory. The required turning and door clearance may need to take into consideration any lifting device used for transporting the instrument (for example, fork lift, pallet truck or trolley).

☑ After the in-house transit route requirements have been met, check the checklist box: *Entrance to the lab is at least 1450 cm (57.1 in) wide.*

☑ After the instrument is unpacked and on the bench top, check the checklist box: *Instrument unpacked and placed on the workbench.*



6. Software Installation Guidelines

Installing the Microsoft Windows Operating System 73
Installing Agilent SpectrAA Software 74
Installing Agilent SpectrAA CFR Software 74

The following information assumes that you are working on a clean, empty hard disk. If you have any other files on the PC hard disk, ensure you make backups of these before continuing.

NOTE Agilent will not assume responsibility for loss of data.

Installing the Microsoft Windows Operating System

For instructions on installing the Microsoft Windows operating system, refer to the Microsoft Windows manuals supplied with the software. If the customer is supplying the PC, it is their responsibility to ensure Microsoft Windows is installed.

- SpectrAA Base (for use with SpectrAA Base version 5.2 or greater and Windows 7 Professional 64-bit SP1 operating systems)
- SpectrAA PRO (for use with SpectrAA PRO version 5.2 or greater and Windows 7 Professional 64-bit SP1 operating systems)
- SpectrAA CFR (for use with SpectrAA CFR software version 5.1 and Windows XP SP3 operating systems only)

NOTE To ensure correct operation, the user installing the operating system must have Administrator privileges for correct installation of Agilent AA software.

Installing Agilent SpectrAA Software

For instructions on installing Agilent AA software, refer to the user's guide that came with your instrument.

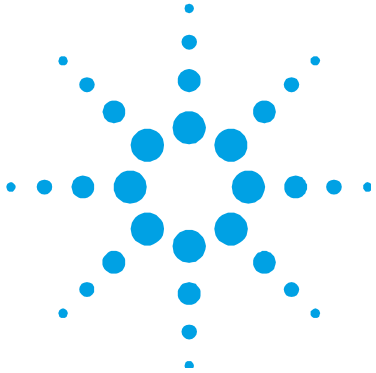
Installing Agilent SpectrAA CFR Software

Agilent SpectrAA CFR software should be installed by the System Administrator and the System Administrator must be onsite during installation of the Agilent AA instrument.

NOTE Agilent SpectrAA CFR software requires either SpectrAA Base or Pro software to be installed prior to installation.

NOTE SpectrAA CFR software requires the file system to be NTFS and not FAT32. This is to be set up when installing the Windows operating system.

Refer to the '21 CFR Part 11 Electronic Records, Electronic Signatures Compliance' manual and the CFR Assistant Help supplied with the SpectrAA CFR software for details on how to use the CFR Assistant to configure the Microsoft Windows operating system and for details on setting up users and assigning user privileges.



7. Operator Training

Operator confidence when using atomic absorption instrumentation is essential to obtain accurate and reliable results. The Agilent field service engineer who installs your equipment will demonstrate the basic operating procedures while conducting the installation performance tests. The engineer is not necessarily experienced in more complex analytical procedures and is *not* authorized to conduct extended training. The controlling software runs on the Microsoft Windows 7 64-bit SP1 or Windows XP 32-bit SP3 (for CFR systems only) operating systems. The service representative will explain elementary operations but is *not* authorized to conduct extended training on the Microsoft Windows operating system.

Your operators will gain most from observing the installation and will be more immediately productive if they have already been trained. Agilent recommends that you take advantage of special training courses that are conducted at various locations by the Agilent technical support organization.

In some locations, it may be possible to arrange for operator training after the installation, using your own instrument. Contact your Agilent sales and service office if you would like to arrange this.

This page is intentionally left blank.

www.agilent.com

In This Guide

The guide describes the following:

- Safety Practices and Hazards
- Introduction
- Laboratory Environment
- Laboratory Facilities
- Instrument Shipping Information
- Software Installation Guidelines
- Operator Training

© Agilent Technologies 1994, 1995, 1997, 1998, 2000–2003, 2007, 2010 and 2012

Printed in Malaysia
01/12

8510119300
Issue 13

Agilent Technologies